The Transfer Problem Revisited:

Net Foreign Assets and Real Exchange Rates

Philip R. Lane
Trinity College Dublin and CEPR

Gian Maria Milesi-Ferretti
International Monetary Fund and CEPR

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Abstract

What are the implications for the real exchange rate of the need for debtor countries to run trade surpluses in the long run so as to service their external liabilities? Using a newly assembled data set on the net external position of industrial and developing countries (Lane and Milesi-Ferretti (1999a) the paper revisits this long-standing issue in international economics (the transfer problem). It presents a simple theoretical framework that leads to empirically testable implications on the long-run co-movements of real exchange rates, net foreign assets, relative GDP and terms of trade, and cross-country and time-series evidence on the subject. It is shown that on average countries with net external liabilities have more depreciated real exchange rates. The main channel of transmission seems to work through the relative price of nontraded goods, rather than through the relative price of traded goods across countries.

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Introduction

The relationship between international payments and the real exchange rate is one of the classic questions in international economics. In the 1920s, Keynes (1929) and Ohlin (1929) debated this transfer problem in the context of the German war reparations. More recently, the 1980s debt crisis, the 1997 Asian crisis and the ever-growing external liabilities of the United States have led to a resurgence of interest on this topic, in view of the central prediction that the international investment income flows associated with non-zero net foreign asset positions require some degree of real exchange rate adjustment in the long run.[1] By extension, in terms of the current policy debate concerning the exchange rate regime choices of emerging market economies, the operation of a powerful transfer effect may suggest a preference for nominal exchange rate flexibility in order to allow the real adjustment to take place as smoothly as possible.[2] Finally, the transfer effect plays a central role in many "new open-economy macroeconomic" models that highlight the role of the net foreign asset position as a state variable that can generate persistent effects from even temporary shocks (Obstfeld and Rogoff 1995, Lane 1999).

There is a vast literature on the determinants of real exchange rate behavior (see, for example, the recent surveys by Froot and Rogoff (1995), Rogoff (1996) and, for developing countries, Edwards and Savastano (1999) and Hinkle and Montiel (1999)). However, relatively little empirical work has been done to assess the quantitative significance of the transfer effect. We suspect that the paucity of data on net foreign asset positions is primarily responsible for the lack of research contributions in this area. In recent work (Lane and Milesi-Ferretti 1999a), we have sought to remedy this situation by constructing new estimates of foreign asset and liability positions for a large set of industrial and developing nations. Our goal in this paper is to exploit this new data set in order to provide a comprehensive investigation of the empirical importance of the transfer effect.

A second motivation for the study is that the small extant literature that has examined this topic has focused almost exclusively on the terms of trade as the mechanism by which international transfers affect relative prices, in line with the original argument by Keynes (see, for example, Broner et al. (1997)). We are uncomfortable with this approach for several reasons. First, the terms of trade are endogenous to an individual country only if it exerts significant market power in its export/import markets. While this may be relevant for the largest industrial countries, it may not be so important for small or developing economies. Rather, for many countries, the terms of trade are instead an important source of exogenous fluctuations in the real exchange rate. Second, an exclusive focus on the terms of trade neglects the potentially large impact of international transfers on the relative price of nontradables, an effect already emphasized by Ohlin (1929). We seek to redress this imbalance by emphasizing the role played by the relative price of nontradables in determining long-run exchange rate behavior, especially in developing countries.

Several theoretical models predict that real appreciations should be associated with accumulation of net foreign assets in the long run. In a simple Keynesian setting, countries with large external liabilities need to run large trade surpluses in order to service them, and achieving these trade

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[1] See Krugman (1999) amongst others.

[2] Goldfajn and Valdes (1999) show that real exchange rate adjustment typically takes place via nominal exchange rate adjustment.

surpluses requires (by assumption) a more depreciated level of the real exchange rate. Mussa (1984) presents a simple model of a small open economy consuming an exportable and an importable good where the trade balance depends on a country's terms of trade, and a country's accumulation of net foreign assets depends on rate-of-return differentials and on the difference between actual and desired level of net foreign assets. The model implies a positive long-run co-movement between terms of trade and net foreign assets. Broner et al. (1997) extend Mussa's model to allow for nontraded goods as well. In the long run the net foreign asset position (which is equal to the desired one) uniquely determines the terms of trade (which are the sole determinants of the trade balance).[3]

In intertemporal optimizing models, the transfer effect can operate in the presence of a home preference for domestic exports, or through the impact of wealth effects on labor supply. In the former case (see, for example, Buiter (1989)), a transfer from the home to the foreign country implies a decline in global demand for home goods, and hence necessitates a fall in their relative price.[4] In the latter case (see, for example, Obstfeld and Rogoff (1995)), a transfer from the home to the foreign country reduces domestic wealth and hence raises labor supply and the supply of exportables, affecting their relative price. Another alternative, presented in Obstfeld and Rogoff (1996), is a Ricardian model where a range of goods is not traded, due to transport costs. In this setting, a transfer from the home to the foreign country raises spending on foreign nontradables: foreign wages rise, the foreign export sector declines and the home export sector expands. The foreign terms of trade improve and the foreign real exchange rate appreciates. The latter is due to (a) an increase in price of nontradables, due to higher wages; (b) a larger fraction of tradables are imported from home so that higher fraction of tradables incur transport costs, raising prices. Note that the terms of trade improve but this is not the reason the real exchange rate appreciates: the terms of trade have no impact on the real exchange rate because both countries consume the same bundle of tradables.

In the next Section, we develop an alternative intertemporal optimizing model of the transfer effect, in which an endogenous relative price of nontradables is the mechanism linking international payments and the real exchange rate. We show that the real exchange rate is also influenced by relative output levels and exogenous shocks to the terms of trade. Based on this theoretical work, we derive a specification that drives the empirical work in the rest of the paper.

Our empirical results show a strong cross-sectional correlation between changes in real exchange rates and changes in net foreign assets, in both industrial and developing countries. A significant transfer effect is also found in the fixed-effects panel estimation. Moreover, we show that the magnitude of the transfer effect systematically varies with country characteristics such as trade openness, output per capita, country size, the composition of external liabilities and restrictions on the external payments system.

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[3] These are reduced-form models. In the Broner et al model, the relative price of nontraded goods also potentially depends on the desired net foreign asset position but the sign is ambiguous. Moreover, its role is purely the achievement of "internal balance": the trade balance only depends on the terms of trade. Mussa (1984) recognizes that his model is isomorphic to one in which the terms of trade are exogenous and adjustment takes place via endogenous shifts in the relative price of nontradables. Alberola et al (1999) employ a similar model.

[4] Keynes (1929) argued that in order for a transfer effect to exist, there must be a difference in the composition of spending between the country effecting the transfer and the recipient: "If £1 is taken from you and given to me and I choose to increase my consumption of precisely the same goods as those of which you are compelled to diminish yours, there is no Transfer Problem." (page 2).

The rest of the paper is organized as follows. Section 2 presents the model. Section 3 describes the data we employ. In section 4, we present the empirical results for cross-section, time-series and panel dimensions of the data. Section 5 provides a comparison with other empirical studies. Section 6 concludes.

Theory

We consider a small open economy model.[5] We assume the output of the tradable sector is an endowment Y_T that sells on world markets at the export price P_T^x in units of the imported tradable consumption good, which is the numeraire. For simplicity, domestic consumption of the export good is zero. By this definition, P_T^x is the terms of trade (the ratio of export prices to import prices). Labor is supplied to a competitive nontraded sector.

Agent j has the objective function

$$V_j = \sum_{t=0}^{\infty} \beta^t \left[\frac{\sigma}{\sigma - 1} C_t^{\frac{\sigma-1}{\sigma}} - \frac{\kappa}{2} l_{Nt}^{\ 2} \right] \tag{1}$$

where $\beta \in (0,1)$ and σ, κ >0. The consumption index C_t aggregates consumption of traded and nontraded goods

$$C_t = \left[\gamma^{\frac{1}{\theta}} C_{Tt}^{\ \frac{\theta-1}{\theta}} + (1-\gamma)^{\frac{1}{\theta}} C_{Nt}^{\ \frac{\theta-1}{\theta}} \right]^{\frac{\theta}{\theta-1}} \tag{2}$$

where θ is the constant elasticity of substitution between traded and nontraded goods. The second term in the objective function V_j captures the disutility of work effort, where l_{Nt} is the amount of labor supplied to the nontraded sector.

The agent can invest in an international real bond, denominated in units of the import good. The flow budget constraint faced by agent j is given by

$$B_{t+1} = (1+r)B_t + w_t l_{Nt} + P_{Tt}^{\ x} y_T - P_t C_t \tag{3}$$

B_t denotes real bonds (in units of the tradable good) that pay off a real return r, which is given exogenously. The nominal wage is w_t and the consumption price index is given by

$$P_t = \left[\gamma + (1-\gamma) P_{Nt}^{\ 1-\theta} \right]^{\frac{1}{1-\theta}} \tag{4}$$

where P_{Nt} is the price of the nontradable good.

The real exchange rate is defined as the ratio of the domestic consumer price index to the foreign consumer price index

[5] The model is adapted from Lane (2000).

$$RER_t \equiv \frac{P_t}{P_t^*} = P_t \qquad (5)$$

where we hold fixed the foreign price level fixed at unity throughout the analysis.

The production function in the nontraded sector is linear in labor

$$y_{Nt} = l_{Nt} \qquad (6)$$

and the nominal price of the nontradable is just equal to the wage

$$P_{Nt} = w_t \qquad (7)$$

First-Order Conditions

For simplicity, we assume $\beta(1+r)=1$, which rules out the desire to borrow and lend in the steady-state. Optimal consumption and work effort decisions generate the relationships

$$\frac{C_{Tt+1}}{C_{Tt}} = \left[\left(\frac{P_t}{P_{t+1}}\right)\right]^{\sigma-\theta} \qquad (8)$$

$$\frac{C_{Nt}}{C_{Tt}} = \frac{1-\gamma}{\gamma}\left(P_{Nt}\right)^{-\theta} \qquad (9)$$

$$y_{Nt} = \left(\frac{1}{\kappa}\right) C_t^{-\frac{1}{\sigma}} \left(\frac{P_{Nt}}{P_t}\right) \qquad (10)$$

Equation [8] is the Euler equation governing the dynamic evolution of consumption. The dependence of consumption growth on the sequence of relative prices is the "consumption-based real interest rate" effect, first emphasized by Dornbusch (1983). If the aggregate price level relative to the price of traded goods is currently low relative to its future value, this encourages present over future consumption as the consumption-based real interest rate is lower. However, it also encourages substitution from traded to nontraded goods. The former effect dominates if the intertemporal elasticity of substitution is greater that the intratemporal elasticity of substitution, which occurs if $\sigma > \theta$, and conversely.

Equation [9] links consumption of nontraded and traded goods. The elasticity of substitution is parameterized by θ; if the relative price is unity, the relative consumption of nontraded goods is larger, the smaller is the parameter γ. Finally, equilibrium supply of nontraded goods is given by equation [10]: the higher is the consumption index C, the lower is the level of production, as agents increase leisure in line with consumption of other goods.

Steady-State Analysis

We first consider a benchmark steady state in which all variables are constant. In this benchmark steady state, we assume the stock of net foreign assets is zero. We normalize the endowment of the traded good so that the relative price of nontraded goods in terms of traded goods P_N is unity. We also assume the terms of trade is unity $P_T^{\,x}=1$. In this symmetric equilibrium, the steady-state production and consumption of nontraded and traded goods are given by

$$Y_N = C_N = \left[\frac{1}{\kappa}\right]^{\frac{\sigma}{\sigma+1}}(1-\gamma)^{\frac{1}{1+\sigma}} \tag{11}$$

and

$$C_T = Y_T = \frac{\gamma}{1-\gamma}Y_N \tag{12}$$

From equation [11], production of the nontraded good will be the larger, the less taxing is work effort (the smaller is κ) and the larger is the weight placed on consumption of nontraded goods in the utility function (the larger is (1-γ)).

We next take a linear approximation around this benchmark, to derive the impact of steady-state variation in net foreign assets(B), tradable output (Y_T) and the terms of trade ($P_T^{\,x}$). Let tildes denote percentage changes relative to the benchmark steady-state, such that

$$\tilde{C}_T = r\tilde{B} + \tilde{Y}_T + \tilde{P}_T^{\,x} \tag{13}$$

where $\tilde{B} \equiv dB / C_{T0}$. Three factors drive steady-state consumption of tradables: the net foreign asset position, the level of the tradable output endowment and the terms of trade.

Steady-state variation in production and consumption of nontradables are derived by taking linear approximations to equations (11) and (12)

$$\tilde{Y}_N = \tilde{C}_N = \tilde{C}_T - \theta\tilde{P}_N \tag{14}$$

$$\tilde{Y}_N = \tilde{C}_N = \frac{(\sigma-\theta)\gamma}{1+\sigma}\tilde{P}_N \tag{15}$$

Combining and rearranging equations [13]-[15], we have the expression for the relative price of nontradables

$$\tilde{P}_N = \left[\frac{1+\sigma}{(1-\gamma)\theta + (\gamma+\theta)\sigma}\right]\left(r\tilde{B} + \tilde{Y}_T + \tilde{P}_T^{\,x}\right) \tag{16}$$

or, in log levels,

$$\log(P_N) = \Omega + \frac{\lambda r}{\gamma}\frac{B}{Y_0} + \lambda \log(Y_T) + \lambda \log(P_T{}^x) \tag{17}$$

where Ω is a constant and $\lambda \equiv (1+\sigma)/[(1-\gamma)\theta + (\gamma+\theta)\sigma]$ and $Y_0 \equiv C_0$.[6] According to this expression, the relative price of nontradables is increasing in (a) the level of net foreign assets; (b) the level of (tradable) output; and (c) the terms of trade.

The intuition is straightforward. Any factor that raises consumption of tradables also exerts a positive wealth effect that reduces labor supply to the nontradable sector, leading to a increase in the relative price of nontradables and hence a real appreciation.

We derive the variation in the real exchange rate by

$$\widetilde{RER} = \tilde{P} = (1-\gamma)\tilde{P}_N \tag{18}$$

or, in log levels,

$$\begin{aligned} &\log(RER) = (1-\gamma)\log(P_N) \\ &= (1-\gamma)\Omega + \frac{(1-\gamma)\lambda r}{\gamma}\frac{B}{Y_0} + (1-\gamma)\lambda \log(Y_T) + (1-\gamma)\lambda \log(P_T{}^x) \\ &= \alpha + \beta_1 \frac{B}{Y_0} + \beta_2 \log(Y_T) + \beta_3 \log(P_T{}^x) \end{aligned} \tag{19}$$

where $\beta_1, \beta_2, \beta_3 > 0$. In this setup, the real exchange rate is just a monotonic transformation of the relative price of nontradables.[7] Equation [19] forms the basis for the empirical work in subsequent sections.

Data: Sources and Construction

Our source of data for net foreign asset positions is Lane and Milesi-Ferretti (1999a), to which the reader is referred for a detailed discussion of data construction. Net foreign assets *NFA* are defined as:

$$NFA = FDIA + EQA + DEBTA + FX - FDIL - EQL - DEBTL \tag{20}$$

where *FX* indicates foreign exchange reserves and *FDI*, *EQ* and *DEBT* are the stocks of direct investment, portfolio equity investment and debt instruments, respectively, with the letter *A* indicating assets and the letter *L* liabilities. Since for several countries and time periods we lack direct measures of most stocks in equation [20], we supplement existing stock data with

[6] We derive the log-level equation as a Taylor approximation around the benchmark steady-state.

[7] The level of output should be understood to be measured relative to output overseas. A global tradable output increase would increase the relative price of nontradables in all countries, leaving the real exchange rate unchanged. In the empirics, relative GDP per capita is employed as a proxy for relative levels of tradable output.

cumulative flows. In the absence of valuation changes, we can approximate the change in net foreign assets with the current account balance *CA*, net of capital account transfers *KA*:

$$\Delta NFA \cong CA + KA \tag{21}$$

Estimates of the net foreign asset position are obtained by cumulating the current account balance, net of capital transfers, with several adjustments designed to take into account valuation changes, misreporting of capital flows, and debt reduction or forgiveness agreements. This information is supplemented with direct stock measures for foreign exchange reserves (from International Financial Statistics) and, for developing countries, gross external debt (from the World Bank's Global Development Finance database). The cumulative current account balance is correspondingly adjusted for the difference between the reported flows and the change in the stock. Cumulative portfolio equity flows are adjusted for variations in stock market prices, and are therefore calculated at market value. The cumulative flows of foreign direct investment are instead adjusted for changes in relative prices across countries, and are hence calculated at book value. For developing countries (for which we have direct measures of the stock of external debt) we hence estimate the LHS of equation [20] as well as all components of the RHS except for debt assets, that are determined residually.

The CPI- and WPI-based multilateral real exchange rates were constructed as the ratio between the domestic price index, converted in dollar terms at the period average nominal exchange rate, and a trade-weighted average of trade partners' price indices also expressed in US dollar terms. The trade weights refer to the trade pattern of 1990. Data on nominal exchange rates, consumer and wholesale price indices come from IMF's International Financial Statistics, supplemented for the WPI by data from national sources. The existence of cross-country differences in the construction and coverage of WPI indices, together with their more limited availability implies that the CPI-based real exchange rate measure is more reliable. An additional issue, which is particularly relevant for developing countries in the earlier part of our sample is the existence in a few countries of sizable black-market premia, implying that the official exchange rate cannot really be considered an equilibrium price. [8]In the empirical analysis we highlight when this factor is likely to play an important role.

Our measure of GDP per capita was constructed using Summers and Heston's data on GDP per capita at constant 1985 international dollars, updated to 1997 using the growth rate of per capita GDP calculated by the World Bank. [9] For each country, GDP per capita relative to its trading partners is constructed following the same methodology and trade weights used for the construction of the real effective exchange rate. The terms of trade are defined as the ratio of a country's export prices (or export unit values) to its import prices (or import unit values), both expressed in US dollars. The primary source of data for the terms of trade is the IMF's *International Financial Statistics.* For the countries for which IFS data were not available, we relied on the IMF's *World Economic Outlook* database and on the World Bank's *World Development Indicators* database.

[8] The data on black market premia, based on Pick's Currency Yearbook, where obtained from the World Bank. We thank Luis Servén for providing the data.

[9] Results are analogous when we use an index of GDP volume at 1990 prices from the IMF's International Financial Statistics divided by population.

Empirical Methodology

We examine several dimensions of the data. We first study the cross-sectional evidence where the specification is

$$\begin{aligned}&\log(RER_{i,tT}) - \log(RER_{i,st}) \\ &= \alpha + \beta_{xs}{}^{NFA} * (NFA_{i,tT} - NFA_{i,st}) + \beta_{xs}{}^{YD} * [\log(YD_{i,tT}) - \log(YD_{i,st})] \\ &+ \beta_{xs}{}^{TT} * [\log(TT_{i,tT}) - \log(TT_{i,st})] + \varepsilon_{i,xs}\end{aligned} \qquad (22)$$

where st and tT denote average values over the intervals [s,t] and [t,T] respectively.[10] For the cross-section, it is necessary to look at "differences on differences" since the real exchange rate and terms of trade variables are index-based such that levels are not directly comparable across countries.

We next turn to panel evidence. The general specification is

$$\begin{aligned}&\log(RER_{it}) = \alpha_i + \phi_t + \beta_i^{NFA} * NFA_{it} + \beta_i^{YD} * \log(YD_{it}) + \beta_i^{TT} * \log(TT_{it}) \\ &+ \sum_{k=-1}^{k=1} \nu_k{}^{NFA} \Delta NFA_{it+k} + \sum_{k=-1}^{k=1} \nu_k{}^{YD} \Delta \log(YD_{it+k}) + \sum_{k=-1}^{k=1} \nu_k{}^{TT} \Delta \log(TT_{it+k}) + \varepsilon_{it}\end{aligned} \qquad (23)$$

where RER_{it} is the multilateral (CPI or WPI) real exchange rate, α_i is a country dummy, ϕ_t is a year dummy, NFA_{it} is the ratio of net foreign assets to GDP, YD_{it} is GDP per capita relative to trading partner countries, TT_{it} is the terms of trade, Δ denotes the first-difference operator and ε_{it} is a residual term. This specification is a panel version of the dynamic ordinary least squares (DOLS) estimator developed by Stock and Watson (1993). Mark and Sul (1999) and Kao and Chang (1999) provide evidence that DOLS outperforms other panel estimators in obtaining reliable long-run coefficients. We are interested in the long-run β coefficients, since we do not claim that the transfer effect is important for short-run real exchange rate fluctuations. Moreover, given the short span of data, we do not attempt to empirically capture the short-run dynamics or speed of adjustment to the long-run real exchange rate.

The existing empirical literature on real exchange rates that explicitly includes net foreign assets among its determinants focuses mostly on industrial countries, because of data availability on the net foreign asset position (see, for example, Faruqee (1995) and Gagnon (1996)). An exception is Broner et al. (1998) who focus on a sample of 7 Latin American countries with the objective of estimating the degree of real exchange rate "misalignment." Faruqee and Broner et al. use country-by-country time series analysis, while Gagnon uses panel data techniques. Edwards and Savastano (1999) provide a good review of the literature on real exchange rates in developing countries, and highlight in particular the fact that studies so far have focused on flow determinants, rather than stock determinants.

[10] We use period averages rather than end years, since real exchange rates may deviate from fundamental values in the short run.

Cross-Section Results

The question we address in this section is whether changes in the average real exchange rates across countries over prolonged periods of time are correlated with changes in their net external position, relative GDP per capita and terms of trade. In order to undertake this exercise, we calculate the average of these variables for the periods 1975-85 and 1986-96, and then take the difference between the latter and the former. We present results using both the CPI-based and the WPI-based real effective exchange rates. As argued in the previous sections, different channels of transmission of the impact of net foreign asset positions on real exchange rates would imply different correlation patterns with these real exchange rate measures. We first focus on the bivariate correlation between real exchange rate changes and changes in net foreign assets, relative GDP per capita and terms of trade, respectively, and then present multivariate regressions. We report results for the full sample, industrial countries and developing countries. For the latter grouping we present results for a reduced sample as well, which excludes those countries experiencing large changes in the black market premium between the two periods.[11]

Bivariate correlations

Table 1 lists bivariate correlations between changes in our two real exchange rate measures-- Δ RERCPI and ΔRERWPI--changes in net foreign assets (ΔNFA), relative GDP per capita (ΔYD) and terms of trade (ΔTT). The findings can be summarized as follows:

A. ΔRERCPI and ΔNFA are strongly correlated for industrial countries, in line with the prediction of our theoretical model; the correlation is positive but weaker for developing countries (see Figures 1 and 2, first panel). The correlation of ΔRERWPI with ΔNFA is weaker than for the CPI-based measure.[12]

B. ΔRERCPI is strongly correlated with ΔYD in industrial countries, but not in developing countries (Figures 1 and 2, second panel). That is, the bivariate correlations are in line with the predictions of the Balassa-Samuelson hypothesis or the hypothesis of a higher income elasticity for the demand of nontraded goods only for industrial countries.

C. ΔRERCPI and ΔTT are strongly correlated in industrial countries, but not in developing countries (Figures 1 and 2, third panel). In contrast, ΔTT is strongly correlated with ΔNFA as well as with ΔYD in developing countries, but not in industrial countries.[13]

D. ΔNFA and ΔYD are strongly correlated in both industrial and developing countries. In other words, countries that do well in terms of relative per capita growth also tend to have significant improvements in their net external position (Figures 1 and 2, fourth panel).

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[11] One must of course take into account the possibility that the nominal exchange rate on which our real exchange rate calculations are based is not truly an equilibrium price, and hence that sizable black-market premia may exist. In this case, a large measured real depreciation may just be the reflection of, say, a unification in foreign exchange markets with a consequent reduction in the black market premium.

[12] Obstfeld and Rogoff (1995, 1996) find a positive bivariate relation between changes in the WPI-based real exchange rate and the net foreign asset position in a sample of 15 industrial countries. We compare our findings with theirs below.

[13] On the link between growth and the terms of trade in developing countries, see, for example, Mendoza (1997).

While in this paper we do not attempt to model the determinants of net foreign assets, our findings under C and D are interesting empirical regularities.

Multivariate regressions

The results of multivariate cross-country regressions are presented in Table 2. Panel A reports regressions using the CPI-based real effective exchange rate as the dependent variable, panel B using the WPI-based real exchange rate and panel C using the difference between the CPI- and the WPI-based measures. As argued earlier in the paper, we consider the terms of trade to have an important exogenous component, especially for developing countries. Nevertheless, we present results of real exchange rate regressions with and without controlling for the terms of trade, so as to gauge whether the inclusion of this variable affects the economic and statistical significance of the link between real exchange rates and net foreign assets. In addition to its theoretical motivation, controlling for relative output per capita strips out any indirect effects of the net foreign asset position via its impact on relative growth performance. Similarly, by controlling for the terms of trade, the transfer effect we obtain must operate via the relative price of nontradables.[14]

For the whole sample, changes in the CPI-based real exchange rate (panel A) are positively correlated with changes in the net foreign asset position but uncorrelated with changes in relative income or the terms of trade.[15] For industrial countries, net foreign assets are significantly positively correlated with the CPI-based real exchange rate only if the terms of trade are included. The collinearity between changes in NFA and in relative GDP per capita (see Table 1) explains why the positive and significant bivariate correlations of these variables with changes in the real exchange rate do not "survive" in a multi-variate regression. For developing countries, changes in NFA are strongly correlated with changes in the CPI-based real exchange rate. The terms of trade have a statistically and economically significant impact on the real exchange rate in industrial countries, but, somewhat surprisingly, not in developing countries. The overall fit of the regression improves substantially when we exclude countries that experienced large changes in the black market premium over the sample period.

As the bivariate correlations suggest, the WPI-based real effective exchange rate shows a weaker relation with net foreign assets for both industrial and developing countries, both statistically and economically (panel B).[16] The overall fit of the regressions is also generally poorer; this may be in part due to the fact that there are substantial cross-country differences in the way wholesale price indices are measured. These results suggest that the relative price of nontraded to traded goods is an important channel of transmission from the net external position to the real exchange rate. In order to investigate this hypothesis further, we have regressed changes in the difference

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[14] In theory, the transfer mechanism may systematically affect deviations from the law of one price in tradables. Since we do not have a model making the case for this channel, we ignore it in what follows.

[15] There is a possible endogeneity problem in that NFA/GDP is measured in US dollars. A nominal depreciation causes both the real exchange rate to depreciate and dollar GDP to fall. If the country has net external liabilities primarily denominated in US dollars, the ratio of NFA to GDP would deteriorate. This effect would be partly offset by the dynamics of equity and direct investment liabilities, whose dollar value falls when the nominal exchange rate depreciates. Note also that if the country is a foreign-currency creditor, the bias is in the opposite direction (real depreciation associated with an improvement in the NFA/GDP ratio). Since we are looking at long-run effects, the problem is likely to be less serious than at higher frequencies (e.g. real and nominal exchange rates are less correlated at lower frequencies). Moreover, we lack good instruments for NFA positions.

[16] To conserve space, we do not present the RERCPI results for the 'balanced' sample for which both CPI and WPI data are available. In fact, the difference between RERCPI and RERWPI results are even stronger for that sample.

between the CPI and the WPI-based real exchange rates (DIFF)—which is a proxy for the relative price of nontraded to traded goods across countries—on changes in the net external position and relative GDP per capita (panel C).[17] Overall, we find a positive and significant correlation between DIFF and the change in net foreign assets. For industrial countries, there is a positive and significant correlation between DIFF and relative growth, as would be suggested, for example, by the Balassa-Samuelson hypothesis or by a higher income elasticity of demand for nontraded goods.[18] For developing countries, the relation between DIFF and relative output changes is negative, albeit not significant, confirming that for these countries there is little evidence of Balassa-Samuelson-type effects.

Overall, the cross-sectional evidence we presented suggests the presence of a transfer effect, acting mainly through the relative price of nontraded goods. We turn now to panel evidence.

Panel Evidence

Rather than reporting a country-by-country characterization of determinants of real exchange rates, we pool countries according to various criteria and present panel data analysis. It is well known that it is very difficult to establish whether variables are I(0) or I(1). Following Maddala and Kim (1998) and Mark and Sul (1999), Table 3 presents results of a Fisher test of the stationarity of the residuals from our panel regression. The test clearly indicates that the null hypothesis of nonstationarity is rejected, suggesting a stationary relationship between real exchange rate, net foreign assets, relative output and the terms of trade.[19]

Table 4 presents the result of panel regressions, based on the specification in equation [23]. All regressions are DOLS(-1,1) specifications and include country fixed effects as well as fixed time effects in columns (2), (4) and (6).[20] Note that country dummies are necessary because both the real exchange rate and relative output are indices and hence not comparable in levels across countries. In panel A and B, the dependent variables are the CPI-based and WPI-based real exchange rates, respectively. In panel C, the dependent variable is *DIFF*, the log ratio of the CPI-RER to the WPI-RER.

Overall, a number of stylized features of the data emerge clearly from these regressions:

1. There is a positive and strongly significant long-run relation between the real exchange rate and net foreign assets for the full sample and in both industrial and developing countries, providing support for the existence of a powerful transfer effect. The coefficient magnitudes are remarkably similar across industrial and developing country subsamples and are in line with those obtained in the cross-sectional analysis. The size of the transfer effect is economically significant: according to the estimated point coefficient in column (1) of Table 2, moving from the Danish average net foreign asset position (net liabilities equal to 26 percent) to the Dutch average net foreign asset position (net assets equal to 24 percent of GDP) implies a long-run real

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[17] Adding the terms of trade to the regression does not alter the results in any way.

[18] On the former topic, see, for example, Asea and Mendoza (1994), De Gregorio et al. (1994) and the recent treatment in Canzoneri et al. (1999). On the latter, see, for example, Bergstrand (1991).

[19] Panel cointegration tests such as Kao (1997) and Pedroni (1999) also strongly indicate a stationary relationship. These tests were implemented using the GAUSS program of Chiang and Kao (2000).

[20] In fact, OLS estimation gives very similar estimates and levels of precision for the transfer effect. Mark and Sul (1999) propose a method of correcting the long-run standard errors, which we are currently investigating.

appreciation of 16 percent.[21]

2. The relation between the CPI-based real exchange rate and net foreign assets is stronger than the relation between the WPI-based real exchange, again confirming the cross-sectional results. This is confirmed in Table 4, panel B: net foreign assets have a significantly positive effect on DIFF. This is especially strong for the developing country sample.

3. In the industrial country subsample there is a significant positive effect of relative output on the CPI-based real exchange rate and on DIFF. For the full sample and developing country subsample, relative output per capita seems systematically linked to real exchange rate behavior in the long run only when time dummies are omitted. Hence, time dummies seem to capture common factors associated with the relative output performance of developing countries (more favorable during the 1970s until the debt crisis and less favorable thereafter).

4. In industrial countries, improvements in the terms of trade are associated with real appreciations, and the relation is economically and statistically significant. In contrast, there is no clear relation between real exchange rates and terms of trade in the full sample or developing country subsample.

Panel Splits

The panel data regressions presented in the previous section impose cross-country homogeneity of the coefficients on the variables we employ to model the behavior of the real exchange rate. In this subsection, we run the panel regressions for country subgroups, where the sample is split according to country characteristics that may plausibly affect the magnitude of the transfer effect (see Table 5). In Table 5, panel A, the sample is first split into three groups, according to levels of trade openness. As is derived in Appendix B, the theoretical model predicts that (for most parameter values) the transfer effect should be smaller, the more open an economy. This is clearly supported in Table 1: the transfer effect is inversely related to openness. For the least open group, the point estimate is 1.57 but it is only 0.11 for the most open group.[22] It is also noteworthy that impact of relative output also varies with openness--the effect is significantly positive for the most open group but significantly negative for the least open group.

Panel A also presents results for a sample split according to the level of output per capita in 1970 (a split based on 1985 GDP gives very similar results). This is essentially a refinement of the industrial/developing split and allows for different estimates between lower-middle and upper-middle income groups (low income countries are excluded from our sample). Output per capita may proxy for differences in economic structure: it is well known at least from Chenery's work that the size of the nontraded sector has a U-shaped relationship with the level of development. It may also proxy for variation in the composition of net foreign asset positions (Lane and Milesi-Ferretti 1999). It is also the case that the quality of data almost surely varies with the level of development. The results show that the transfer effect weakens as output per capita increases. Indeed, the point estimate turns negative for the highest income group. In contrast, the relative

[21] The empirical estimates are in the range suggested by the theoretical model. For example, if we calibrate the share of the traded sector to be 0.33, the interest rate to be 0.05 and the intertemporal and intratemporal elasticities of substitution each to be 0.5, the theoretical transfer coefficient is 0.38. As discussed in the appendix, the transfer effect is quite sensitive to the openness parameter, and it is proportional to the the assumed interest rate.

[22] Note that, among the industrial countries, country-by-country regressions yield the largest transfer coefficients for Japan and the US, that are the most closed economies.

output effect is strongest for the high-income group. Finally, a positive effect for the terms of trade is only found for the high-income group.

In the first three columns of Panel B we turn to the composition of net foreign assets, splitting countries according to the average gross equity position relative to GDP (using the ratio of equity in gross liabilities gives similar results). The impact of a high equity ratio is ambiguous. On the one side, the existence of an equity premium would mean that a given net foreign asset position is associated with a higher average investment income flow and hence a larger transfer effect. However, Albuquerque (2000) argues that the required return on FDI is actually lower than on debt. In his model, FDI is “inalienable” and hence is protected from expropriation risk such that FDI investors do not require as high a risk premium as debt investors that are more exposed to default risk. Moreover, equity investment may be associated with faster productivity growth, allowing the generation of trade surpluses without major relative price changes.[23] Of course, a high equity component in liabilities may also proxy for other positive characteristics in an economy. Result show that the transfer effect is much larger for countries with a low equity ratio, with the point estimate six times greater than for those countries with a high equity ratio.

In the last three columns of Panel B, the sample is split according to country size (total GDP) in 1970 (once again, a split based on 1985 income makes little difference). The theoretical model strictly refers to small economies, providing one justification to run this experiment. More generally, size may proxy for “natural” openness. We see that the transfer effect is positively related to country size--the largest countries have the biggest transfer effect. This may just reflect that these countries are the most closed in the sense of having the largest nontraded sectors. To the extent that our measure of the terms of trade is imperfect, the positive effect of country size may also reflect an impact on international relative prices: the largest countries may experience a decline in relative export prices in addition to the relative price of nontradables.

Finally, in Panel C we examine various foreign exchange restrictions--current account restrictions, capital account restrictions, multiple exchange rates and restrictions on the surrender of export revenues. The first two columns focus on current account restrictions, the following two on capital controls and the last two on an overall “restrictions” index that averages across the four individual categories. The results here are quite stark: countries with restrictions experience much larger transfer effects. One interpretation is that quantity restrictions magnify the size of the required relative price adjustment to achieve the same improvement in the trade balance.

Relationship to Other Studies

We turn now to a comparison of our results with those obtained by the few studies that have addressed the link between real exchange rates and the net foreign asset position of countries.[24]

Using a sample of fifteen industrial countries, Obstfeld and Rogoff (1995, 1996) estimated a cross-sectional bivariate regression of the WPI-based multilateral real exchange rate on net foreign assets, with the variables expressed as changes between 1981-85 and 1986-90 averages.

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[23] This is especially the case with respect to FDI, but in principle positive productivity gains may come from portfolio equity investment as well.

[24] Masson et al. (1994) try to endogenize the post-war behavior of net foreign assets in Germany, Japan and the United States. For these countries, the authors find some evidence of long-run co-movements between the ratio of NFA to GDP, the ratio of public debt to GDP and demographic variables. They do not investigate the relationship between net foreign asset positions and real exchange rates.

They obtained a significantly positive point coefficient, equal to 1.04 in magnitude. In the cross-section component of this paper, we have greatly extended the time period and range of countries included in the sample. Moreover, in estimating the transfer effect, we control for relative output per capita and the terms of trade. This is important, especially in view of the significantly positive correlation between changes in the net foreign asset position and changes in relative output per capita. In Table 2, we found the magnitude of the transfer effect on the CPI-based real exchange to be in the 0.25-0.35 range and the effect on the WPI-based index to be much weaker. For the Obstfeld-Rogoff sample, using our data and time periods, a simple regression of the CPI-based real exchange rate on net foreign assets yields a significantly positive point coefficient of 0.64 but net foreign assets are not individually significant once we control for output per capita. Moreover, for this subsample, the transfer effect is not individually significant in any of the WPI-based real exchange rate regressions.

With respect to time series analysis, Faruqee (1995) estimates real exchange rate equations for the US and Japan, including in the cointegrating vector the real exchange rate, the terms of trade, the CPI to WPI ratio and net foreign assets (as a ratio of GDP) (see also Clark and McDonald (1998)). They find a positive and significant impact of net foreign assets on real exchange rates. However, this finding is difficult to interpret, given that the two channels through which it can have an impact on the real exchange rate (the terms of trade and the relative price of nontraded to traded goods) are both controlled for, albeit imperfectly, in the regression. Broner et al. (1998) estimate real exchange rate cointegrating regressions for the largest Latin American countries. According to their theoretical model, net foreign assets affect the real exchange rate through their impact on the terms of trade. Their dependent variable is the CPI-based real exchange rate, and among their explanatory variables they include the ratio between the CPI and WPI indices (relative to the same ratio in partner countries) in addition to the ratio of net foreign assets to GNP. Their findings suggest a statistically significant relation between RER and NFA for some but not all the countries in their sample. The key issue is of course the degree of endogeneity of the terms of trade for these countries. Moreover, by holding fixed the relative price of nontradables, these authors rule out the very mechanism that we emphasize.

The only other paper that directly studies the long-run relation between the real exchange rate and net foreign assets (expressed as a fraction of trade flows) in a panel data context is Gagnon (1996).[25] That paper focuses on industrial countries and uses a crude estimate of the net foreign asset position, namely the unadjusted cumulative value of the current account. The econometric methodology adopted by Gagnon consists in panel regressions in error-correction form, with explicit allowance for short-term dynamics, along the lines of Phillips and Loretan (1991). The findings suggest a positive short- and long-run relation between both the CPI-based and the WPI-based real exchange rate (measured vis-à-vis Germany) and net foreign assets, of similar orders of magnitude. These effects are obtained holding fixed, among the other explanatory variables, the log-ratio of CPI to WPI, to proxy for Balassa-Samuelson effects. In this paper we argue instead that the relative price of nontraded to traded goods can itself be related to the net external position, and therefore find our empirical specification to be preferable.

[25] Alberola et al. (1999) use panel data techniques to establish cointegration in their industrial country study, but they use individual time series to estimate equilibrium exchange rates.

Conclusions

In this paper we have presented a stylized model to study the "transfer effect". The model yields testable predictions concerning the long-run relation between real exchange rates, net foreign assets, relative output and the terms of trade. Cross-country and time-series empirical evidence suggests the existence of a long-run relation between net foreign assets and real exchange rates, with debtor countries having more depreciated real exchange rates. The evidence also suggests that the relative price of nontraded to traded goods plays an important role in this long-run relation, and hence that an exclusive focus on the terms of trade as the key relative price in the transfer effect is unsatisfactory.

APPENDIX A: CPI-based and WPI-based Real Effective Exchange Rates

Empirically, we primarily examine the CPI-based real exchange rate. The CPIs of the home and trade-weighted average of partner countries are

$$\log(CPI) = \phi_1 \log(P_N) + \phi_2 \log(P_T{}^h) + \phi_3 \log(P_T{}^f) \qquad \text{(A.24)}$$

$$\log(CPI^*) = \phi_1^* \log(P_N{}^*) + \phi_2^* \log(P_T{}^{*h}) + \phi_3^* \log(P_T{}^{*f}) \qquad \text{(A.25)}$$

where $\phi_1, \phi_2, \phi_3 > 0, \sum \phi_i = 1$, $P_T{}^h$ is the price of the domestically-produced tradable and $P_T{}^f$ is the price of the foreign-produced tradable and * denotes the corresponding foreign values. It follows that the CPI-based real exchange rate can be written as

$$\log(RER_C) = \phi_1 \left[\log(P_N / P_T{}^f) - \log(P_N{}^* / P_T{}^{*f}) \right] + (\phi_2 - \phi_2^*) \log(P_T{}^h / P_T{}^f) + (P_T{}^f - P_T{}^{*f}) \qquad \text{(A.26)}$$

where we assume $\phi_1 = \phi_1^*$ and $\log(P_T{}^h / P_T{}^f) = \log(P_T{}^{*h} / P_T{}^{*f})$. We can further simplify this expression if we assume similar consumption patterns across countries ($\phi_2 = \phi_2^*$) and no (long-run) deviations from the law of one price ($P_T{}^f = P_T{}^{*f}$)

$$\log(RER_C) = \phi_c \left[\log(P_N / P_T{}^f) - \log(P_N{}^* / P_T{}^{*f}) \right] \qquad \text{(A.27)}$$

where $\phi_1 = \phi_c$. This provides the empirical link between the determinants of the relative price of nontradables (at home versus overseas) and the CPI-based real exchange rate.

We also consider the WPI-based real exchange rate. WPIs are calculated on the basis of domestic output prices, primarily in the tradables sector. Home and foreign WPIs can be written as

$$\log(WPI) = \phi_w \log(P_{wN}) + (1 - \phi_w) \log(P_{wT}{}^h) \qquad \text{(A.28)}$$

$$\log(WPI^*) = \phi_w \log(P_{wN}{}^*) + (1 - \phi_w) \log(P_{wT}{}^{*f}) \qquad \text{(A.29)}$$

where the subscript w denotes wholesale prices and we assume complete specialization in trade and the same WPI weight on nontraded goods in both countries. For a given set of commodities, the pattern of wholesale prices may differ from consumer prices on account of differences in the distribution sector. In addition, the WPI includes the prices of intermediate goods in addition to final goods: we ignore this complication here, for expositional purposes.

After some manipulation, we can write the WPI-based real exchange rate as

$$\log(RER_w) = \phi_w \left[\log(P_N / P_T^{\,f}) - \log(P_N^{\,*} / P_T^{\,*f}) \right] + (1-\phi_w)\log(P_T^{\,h} / P_T^{\,f}) + \Psi \quad \text{(A.30)}$$

where we assume that wholesale and consumer prices for each item are proportional and that any (long-run) deviations in the law of one price are exogenous ($\log(P_T^{\,f} / P_T^{\,*f}) = \Psi$).[26]

Comparing the expressions for the CPI- and WPI-based real exchange rates, we expect the determinants of the relative price of nontradables to exert a larger effect on the CPI-based real exchange rate to the extent that $\phi_c > \phi_w$. The exception is that the terms of trade may have a larger influence on the WPI-based real exchange rate, since it now has a direct impact, in addition to its indirect influence on the relative price of nontradables. Finally, recall that our maintained assumption is that the terms of trade are exogenously determined. Under alternative models in which the transfer effect primarily operates via an endogenous terms of trade, the net foreign asset position would have a larger unconditional effect on the WPI-based real exchange rate than on the CPI-based real exchange rate.

APPENDIX B: Openness and the Transfer Effect

In this appendix, we examine the impact of variation in openness on the magnitude of the transfer effect. Equation (17) in the main text shows the determinants of the (log) relative price of nontradables. The coefficient on net foreign assets can be rewritten as

$$T^N = \frac{r(1+\sigma)}{\gamma[\gamma(\sigma-\theta)+\theta(1+\sigma)]} \quad \text{(A.31)}$$

The parameter γ is the relative size of the traded sector. The sensitivity of T to γ is determined by the denominator of this expression

$$\begin{aligned} D &= \gamma[\gamma(\sigma-\theta)+\theta(1+\sigma)] \\ \frac{\partial D}{\partial \gamma} &= \theta(1+\sigma)+2\gamma(\sigma-\theta) \end{aligned} \quad \text{(A.32)}$$

The derivative is unambiguously positive (a smaller transfer effect as openness increases) if $\sigma \geq \theta$. However, if $\sigma < \theta$, the second term is negative and the overall effect is potentially negative.

Eq.(19) in the main text shows the relation between the relative price of nontradables and the real exchange rate. The transfer coefficient in the real exchange rate equation can be written as

$$T^R = (1-\gamma)T^N \quad \text{(A.33)}$$

so that

[26] For instance, long-run deviations in wholesale prices may be partly attributable to transport costs.

$$\frac{\partial T^R}{\partial \gamma} = -T^N + (1-\gamma)\frac{\partial T^N}{\partial \gamma} \tag{A.34}$$

Although the net effect of openness may still be positive in the case that $\sigma < \theta$, the role of increased openness in "shrinking" the effect of the relative price of nontradables on the real exchange rate means that this is an even more unlikely scenario when looking at the real exchange rate than the relative price of nontradables. Simple simulations show that the “transfer coefficient” is very sensitive to the size of the traded goods’ sector γ and to the level of the interest rate *r*, but less so to the elasticity of intertemporal substitution σ and to the elasticity of substitution between traded and nontraded goods θ.

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Table 1. Cross-sectional correlations

A. Full sample

	ΔRERCPI	ΔRERWPI	ΔNFA	ΔYD	ΔTT
ΔRERCPI	1				
ΔRERWPI	0.72	1			
ΔNFA	0.28	0.21	1		
ΔYD	0.14	-0.06	0.54	1	
ΔTT	0.15	0.17	0.40	0.46	1

* Number of observations: 64 (49 for correlations with RERWPI)

B. Industrial countries

	ΔRERCPI	ΔRERWPI	ΔNFA	ΔYD	ΔTT
ΔRERCPI	1				
ΔRERWPI	0.73	1			
ΔNFA	0.48	0.20	1		
ΔYD	0.45	0.15	0.76	1	
ΔTT	0.56	0.54	0.12	0.14	1

* Number of observations: 22 (20 for correlations with RERWPI)

C. Developing countries

	ΔRERCPI	ΔRERWPI	ΔNFA	ΔYD	ΔTT
ΔRERCPI	1				
ΔRERWPI	0.65	1			
ΔNFA	0.24	0.22	1		
ΔYD	0.02	-0.16	0.52	1	
ΔTT	-0.02	-0.20	0.41	0.45	1

* Number of observations: 42 (29 for correlations with RERWPI)

D. Developing countries (excluding large changes in black market premium)

	ΔRERCPI	ΔRERWPI	ΔNFA	ΔYD	ΔTT
ΔRERCPI	1				
ΔRERWPI	0.58	1			
ΔNFA	0.31	0.22	1		
ΔYD	-0.06	-0.22	0.56	1	
ΔTT	0.16	-0.30	0.40	0.38	1

* Number of observations: 31 (22 for correlations with RERWPI)

Table 2. Determinants of real exchange rates
(change between 1986-96 and 1975-85 averages)*

A. CPI-based real exchange rate

	(1) Full	(2) Full	(3) Industr.	(4) Industr.	(5) Develop	(6) Develop	(7) Develop. Low BMP	(8) Develop low BMP
ΔNFA	0.32 (2.19)*	0.30 (1.97)	0.27 (1.04)	0.25 (2.01)	0.31 (2.55)*	0.34 (2.39)*	0.35 (3.53)**	0.33 (3.01)**
ΔYD	-0.02 (0.10)	-0.05 (0.21)	0.29 (0.97)	0.22 (0.98)	-0.17 (0.79)	-0.13 (0.59)	-0.34 (1.56)	-0.36 (1.57)
ΔTT		0.07 (0.33)		0.45 (2.61)*		-0.12 (0.56)		0.11 (0.69)
Adj. R^2	0.05	0.04	0.17	0.41	0.03	0.01	0.12	0.10
Observations	64	64	22	22	42	42	31	31

B. WPI-based real exchange rate

	(1) Full	(2) Full	(3) Industr.	(4) Industr.	(5) Develop.	(6) Develop.	(7) Develop. low BMP	(8) Develop low BMP
ΔNFA	0.22 (1.69)	0.25 (1.94)	0.14 (0.71)	0.11 (0.98)	0.21 (1.89)	0.20 (1.70)	0.19 (1.95)	0.16 (1.43)
ΔYD	-0.18 (1.17)	-0.30 (1.79)	0.01 (0.05)	0.02 (0.08)	-0.23 (1.49)	-0.19 (1.12)	-0.26 (1.59)	-0.22 (1.30)
ΔTT		0.23 (1.76)		0.37 (3.21)**		-0.08 (0.55)		-0.21 (0.84)
Adj. R^2	0.03	0.08	-0.07	0.19	0.06	0.04	0.08	0.07
Observations	49	49	20	20	29	29	22	22

C. Difference between CPI-based and WPI-based real exchange rate

	(1) Full	(2) Full	(3) Industr.	(4) Industr.	(5) Develop.	(6) Develop.	(7) Develop. low BMP	(8) Develop. low BMP
ΔNFA	0.17 (2.55)*	0.25 (2.33)*	0.30 (3.06)**	0.09 (0.59)	0.15 (2.01)	0.24 (2.06)*	0.21 (2.91)**	0.24 (3.01)**
ΔYD		-0.21 (0.91)		0.48 (2.13)*		-0.25 (1.02)		-0.08 (0.40)
Adj. R^2	0.02	0.03	0.17	0.23	-0.01	0.00	0.06	0.01
Observations	49	49	20	20	29	29	22	22

* t-statistics in parenthesis. * (**) indicates significance at the 95% (99%) confidence level.

Table 3. Fisher Test

	Test Statistic (χ_{2N} distribution)
(RER, NFA, YD, TT)	389.49

Note: See Maddala and Kim (1998) for description of this test.

Table 4. Real exchange rates and net foreign assets: panel data regressions*

A. CPI-based real exchange rates

	(1)	(2)	(3)	(4)	(5)	(6)
	Full	Full Time Dum.	Industrial	Industrial Time Dum.	Developing	Developing Time Dum.
NFA	0.28 (7.98)	0.26 (7.65)	0.19 (3.97)	0.25 (4.7)	0.29 (6.56)	0.25 (6.31)
YD	0.14 (3.15)	-0.003 (-0.07)	0.22 (3.13)	0.19 (2.51)	0.14 (2.57)	-0.07 (-1.31)
TT	0.04 (1.21)	-0.005 (-0.17)	0.17 (4.12)	0.22 (5.00)	0.02 (0.51)	-0.09 (-2.21)
Adj.R^2	0.52	0.57	0.44	0.45	0.42	0.57
N	1558	1558	548	548	1010	1010
Wald F test		10.74 (0.00)		1.54 (0.049)		14.83 (0.00)

B. WPI-based real exchange rates

	(1)	(2)	(3)	(4)	(5)	(6)
	Full	Full Time Dum.	Industrial	Industrial Time Dum.	Developing	Developing Time Dum.
NFA	0.10 (2.84)	0.11 (3.15)	0.07 (1.61)	0.11 (2.37)	0.11 (2.14)	0.10 (2.32)
YD	-0.03 (-0.74)	-0.08 (-1.96)	-0.03 (-0.42)	-0.07 (-1.01)	-0.03 (-0.41)	-0.03 (-0.58)
TT	0.06 (1.71)	0.03 (0.91)	0.14 (4.02)	0.18 (4.70)	0.03 (0.66)	-0.09 (-2.07)
Adj.R^2	0.42	0.49	0.38	0.39	0.32	0.51
N	1086	1086	500	500	586	586
Wald F test		7.13 (0.00)		1.28 (0.18)		9.82 (0.00)

C. Panel "DIFF" regressions**

	(1)	(2)	(3)	(4)	(5)	(6)
	Full	Full Time Dum.	Industrial	Industrial Time Dum.	Developing	Developing Time Dum.
NFA	0.26 (8.94)	0.22 (7.48)	0.08 (2.35)	0.10 (2.68)	0.28 (6.86)	0.23 (5.66)
YD	-0.03 (-0.72)	-0.14 (-0.36)	0.28 (5.55)	0.31 (5.60)	-0.05 (-1.04)	-0.02 (-0.45)
TT	-0.06 (-2.06)	-0.08 (-2.86)	0.04 (1.37)	0.06 (1.89)	-0.08 (-1.97)	-0.11 (-2.78)
Adj.R^2	0.43	0.44	0.42	0.41	0.43	0.46
N	1086	1086	500	500	586	586
Wald F test		1.52 (0.051)		0.61 (0.92)		2.31 (0.00)

* Estimation by Dynamic OLS (one lead and one lag). Heteroscedasticity-consistent standard errors. t-statistics in parenthesis. F-test for exclusion of time dummies (prob in parenthesis).

** Dependent variable is $DIFF = \log(RERC / RERW)$.

Table 5.

A. Openness and income*

	Open low	Open medium	Open High	Income low	Income medium	Income high
NFA	1.57	0.30	0.11	0.30	0.25	-0.07
	(7.76)	(3.99)	(3.77)	(4.68)	(3.77)	(-1.4)
YD	-1.49	-0.03	0.22	-0.35	0.011	0.76
	(-8.39)	(-0.32)	(5.77)	(-4.46)	(0.13)	(14.02)
TT	0.10	0.001	0.051	0.06	-0.17	0.16
	(1.06)	(0.014)	(1.44)	(1.04)	(-2.57)	(3.94)
Adj.R^2	0.61	0.61	0.62	0.62	0.52	0.75
N	349	583	601	454	612	492

* "Open" refers to average trade openness during the period 1970-97, "Income" to GDP per capita in 1970.

B. Equity and Size**

	Equity low	Equity medium	Equity high	Size low	Size medium	Size high
NFA	0.60	0.11	0.09	0.38	0.15	1.41
	(7.39)	(1.85)	(1.80)	(7.96)	(2.03)	(8.40)
YD	-0.23	0.15	0.016	-0.24	0.045	-0.23
	(-2.44)	(2.23)	(0.19)	(-3.13)	(0.72)	(-1.24)
TT	-0.11	0.125	0.21	0.03	0.011	-0.10
	(-1.59)	(2.52)	(3.89)	(0.61)	(0.18)	(-1.24)
Adj.R^2	0.49	0.633	0.54	0.59	0.57	0.50
N	535	613	392	642	523	375

**Equity refers to the average gross equity ratio (FDI assets +FDI liabilities +portfolio equity assets+portfolio equity liabilities divided by GDP) during 1970-97. Size refers to GDP in 1970.

C. Foreign Exchange Restrictions***

	Curr. Acc. No	Curr. Acc. yes	Cap. Acc. no	Cap. Acc. yes	Overall low	Overall high
NFA	0.22	0.585	0.21	0.31	0.15	0.47
	(6.23)	(4.54)	(4.09)	(6.54)	(4.75)	(4.58)
YD	0.03	-0.49	0.05	-0.132	0.14	-0.71
	(0.63)	(-3.28)	(0.73)	(-2.12)	(3.48)	(-5.54)
TT	0.015	-0.03	0.08	-0.06	0.03	-0.02
	(0.44)	(-0.29)	(1.80)	(-1.27)	(1.01)	(-0.18)
Adj.R^2	0.59	0.53	0.586	0.58	0.62	0.561
N	1222	311	808	725	1075	458

*** (1) and (2) split sample between countries without and with current account restrictions respectively. (3) and (4) refer to restrictions on the capital account; (5) and (6) refer to an overall "restrictions index" that averages across the indices of current account restrictions, capital account restrictions, surrender of export proceeds and multiple exchange rates.

FIGURE 1. Real exchange rates, net foreign assets and relative GDP per capita, industrial countries

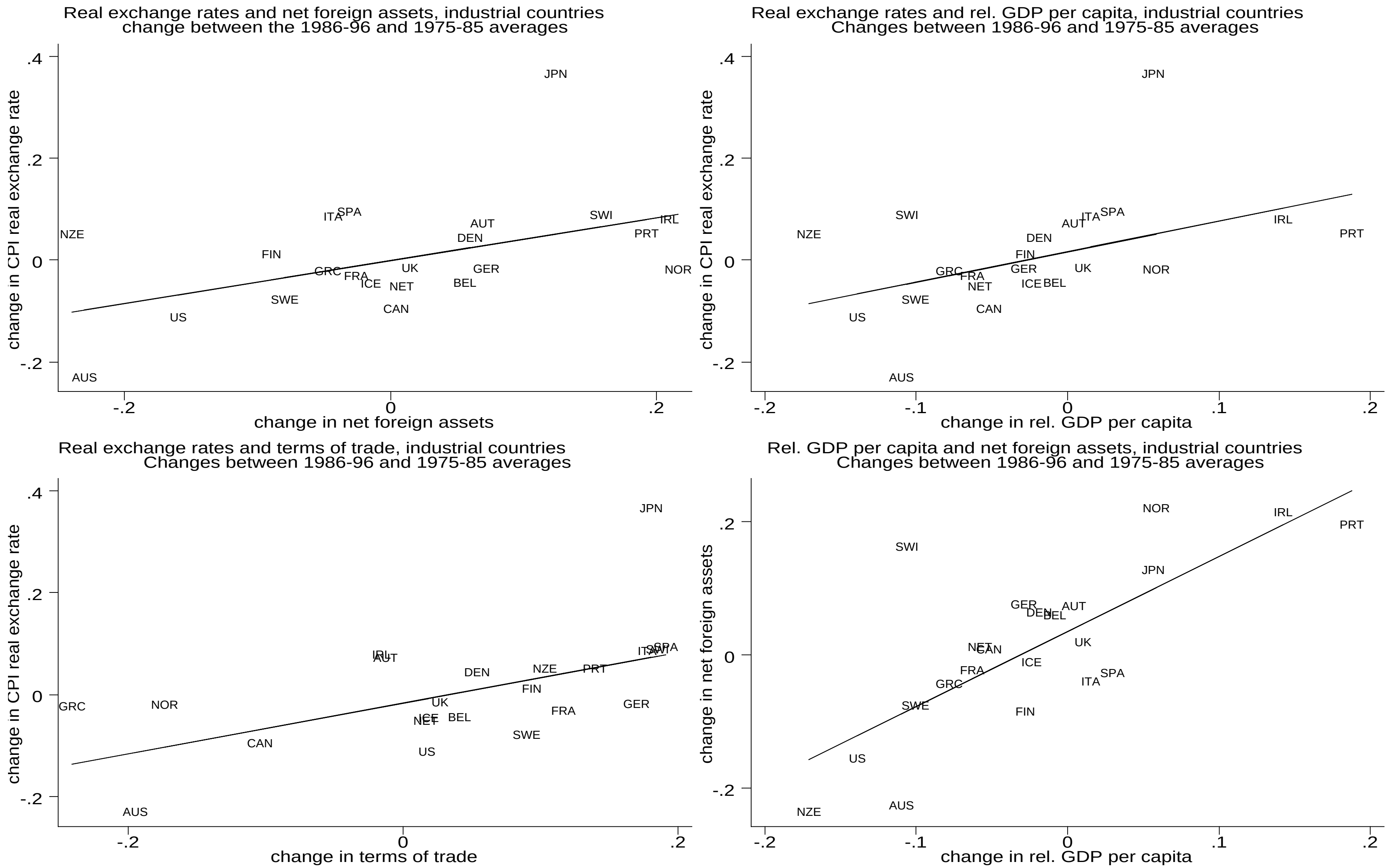

FIGURE 2. Real exchange rates, net foreign assets and relative output, developing countries